Australian Government

ANSTO

Mo-99 at ANSTO

Michael Druce

NNSA Second Mo-99 Topical Meeting

Chicago, April 2013

Australian Government

ansto

Australian Mo-99 History

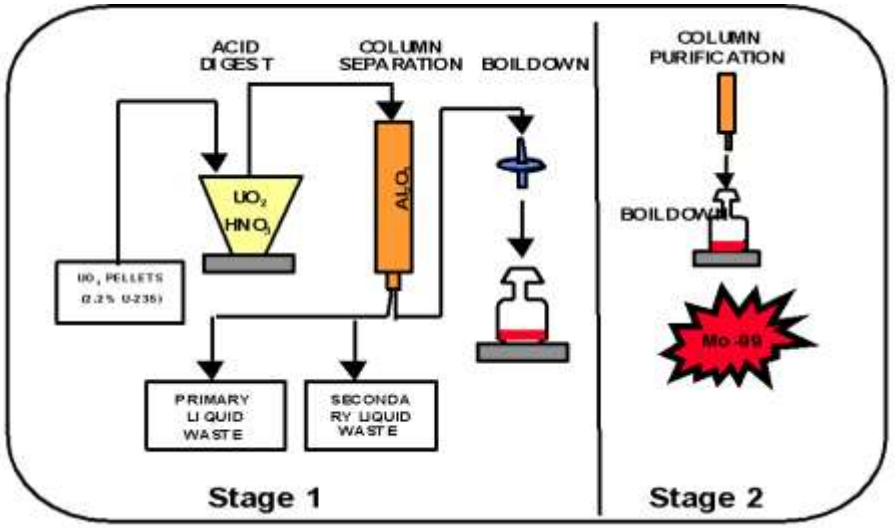
- ANSTO has supplied Mo-99 and Tc-99m to Australia since the late 1970's.
  - Commercial supply accelerated in the 1980's with the development of the Mk11B sterile Tc-99m generator
- Mo-99 has been manufactured by both neutron capture and fission methods.
  - MEK extraction with neutron activation used for over 10 years

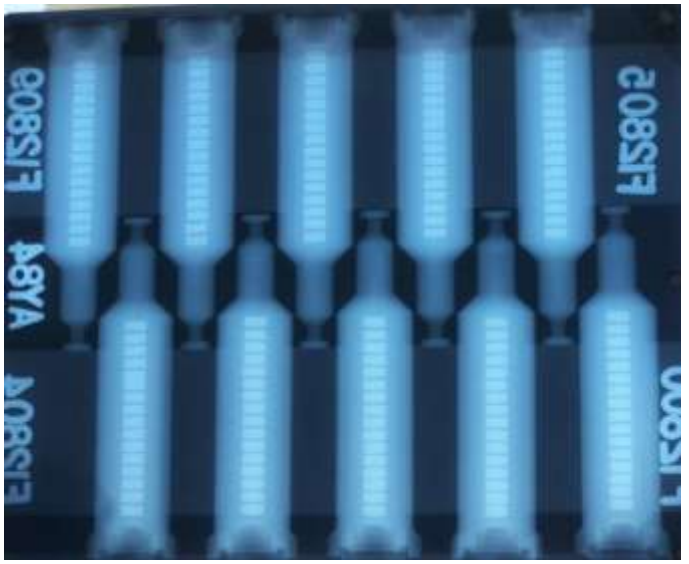
Early 1980's Development

- Development work undertaken
  - Fission Mo-99
  - Gel Generator
  - Chromatographic generator
  - Sublimation generator
- Final decision driven by customer demand for large fission generator

Original Fission Mo-99 Process

Supplied Australia 1982 -2006





- Mass U-Target 240 g UO_2
- Enrichment 1.8% ^{235}U (incr. to 2.2%)
- Average production per run 100 Ci EOP
- Low efficiency but enabled ANSTO to develop a commercial focus and to develop as a reliable supplier

Australian Government

ansto

Need for Increased Production

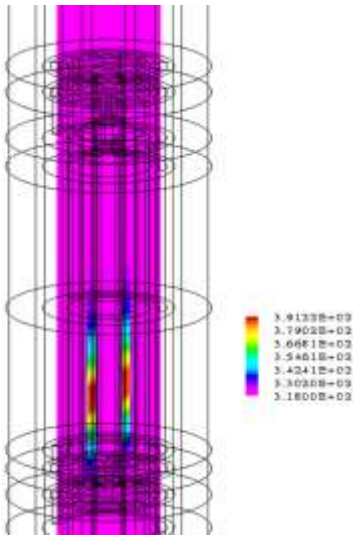
- Demand in Australia increased
  - Looked for new process

- Parameters for new process
  - Must use LEU (<20% U-235).
    - (Australia's commitment to non proliferation)
  - Must meet the requirements of Environmental Approval of OPAL – No increase in gaseous emissions.
  - Must be GMP compliant and safe to operate
  - Must be able to increase production levels.

Australian Government | ansto

Foils

- Program with Argonne to develop Mo-99 from LEU
- Development of uranium foil target
- U foils allows best utilisation of reactor volume and less volumes of waste.



- **Heat Transfer Calculations**
- **Neutronics Calculations**
- **Input in Engineering design of Annular Target**
- **Target Assembly & Disassembly**
- **Manufacture Instrumented Rigs**
- **ARPANSA interaction**
- **Safety Studies**
  - **Review HIFAR OLC's**
  - **Water tunnel experiments**
  - **CFD studies**
  - **Reactor dynamic studies**
- **Safety submission for irradiation**

Australian Government

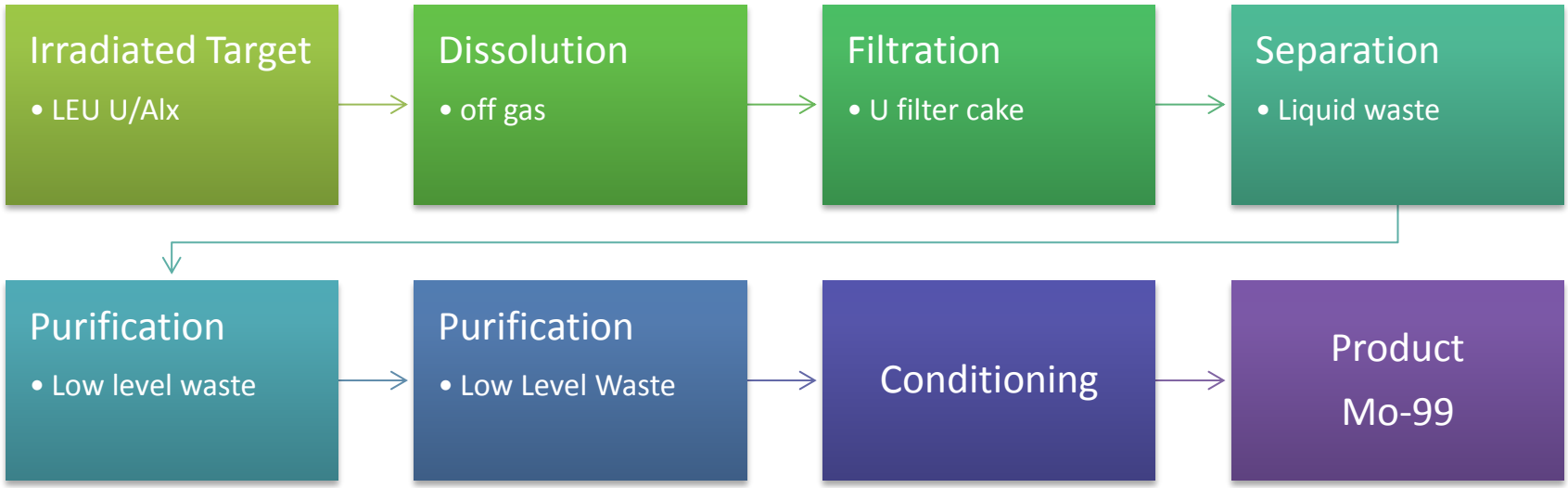
ansto

Review of Project Development

- Challenges encountered
  - Acid dissolution
    - Evolution of radioiodines
    - Criticality considerations in liquid waste
  - Manufacture of foil
    - Routine manufacture of U foils was problematic

- In late 2004, the project was reviewed. It was decided that:
  - The development time for the foil project would be too long.
  - Alternative processes would be assessed.

Process Installed
Base Digestion Mo-99 Process



Australian Government

ansto

ANSTO Mo-99 Operations

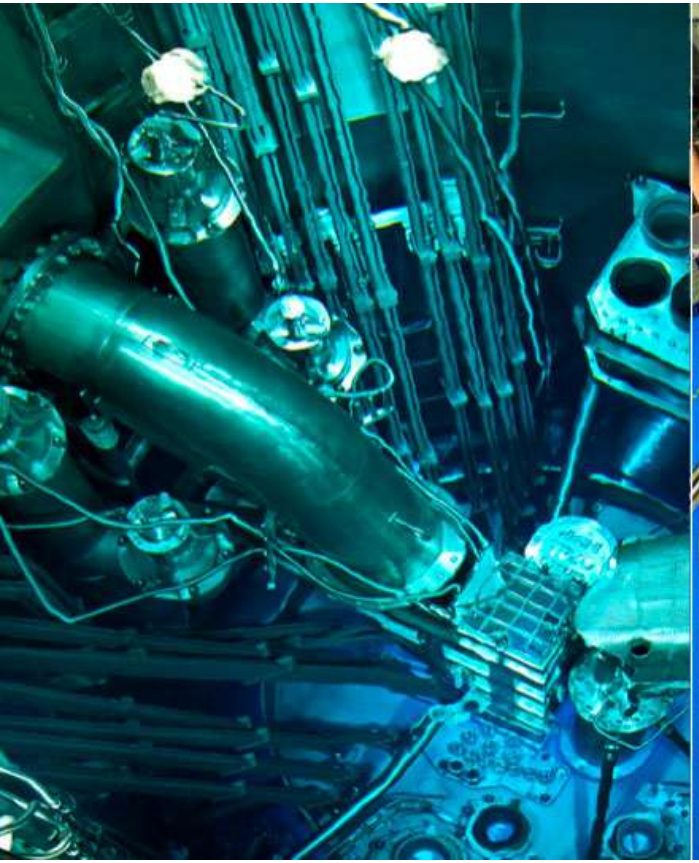
- Has been operating since 2008
  - Process has been fully optimised.
- Initial capacity was 500 ci per week
- During Mo-99 supply crisis ANSTO developed a global perspective to Mo-99 supply and capacity was doubled
- Current capacity is 1000 six day Curies / week

OPAL reactor

LEU fuelled:

- making ANSTO a LEU/LEU Mo-99 producer

Large irradiation capacity



Global Perspective
ANM Pty Ltd

- ANSTO Nuclear Medicine (ANM) Pty Ltd; commercial subsidary of ANSTO.
- Design, build and operate Mo-99 Plant (early 2016)

- Mo-99 Facility: 3,500 6 day Ci per week
  - Using IP licensed from NTP
  - Use of NTP Logistics network
  - Sales through Joint Venture (ANSTO and NTP)
  - Use of LEU fuel and targets

  - Synroc Facility: 100-150 HIP cans/year

Securing Government investment

August 2012

Cabinet approves $168.8 million investment in ANM Project

19 September 2012

Announced by Ambassador David Stewart at the IAEA General Conference

IAEA
International Atomic Energy Agency

19 September 2012

Announced in Parliament by Senator the Hon Chris Evans

Australian Government | ANSTO

Funding

Funding of $168.8M secured by the Australian Government

- To be repaid by ANM Pty Ltd
- After repayment 75% dividend payment to Government
- 25% dividend payment to ANM Pty Ltd

Australian Government

ansto

Location

Australian Government

ansto

Goals Mo-99

- 3500 Ci (six day) Mo-99 per week
  - Up to 1000 Ci in any one day
- 100% reliability in Supply of Mo-99
- Wastes controlled
  - Liquid and solid wastes decay in building before transfer for treatment
  - No increase in gas emissions above current levels
- Working interfaces with other site facilities (OPAL, Waste Management, etc)
- Fully compliant with regulations
- Plant fully operational by end of 2015
  - (requires decisions to be made which will minimise delays)
  - Documentation complete
  - Operators trained and accredited
  - Maintenance and cleaning systems in place
  - Mo-99 registered for use by TGA (and overseas agencies)

Current Status

- Large engineering team working on design
  - Assistance from international consultants
- Concept Design complete
- Preliminary Engineering complete end April 2013
- Regulatory applications made
- Construction to commence early 2014

Thank You